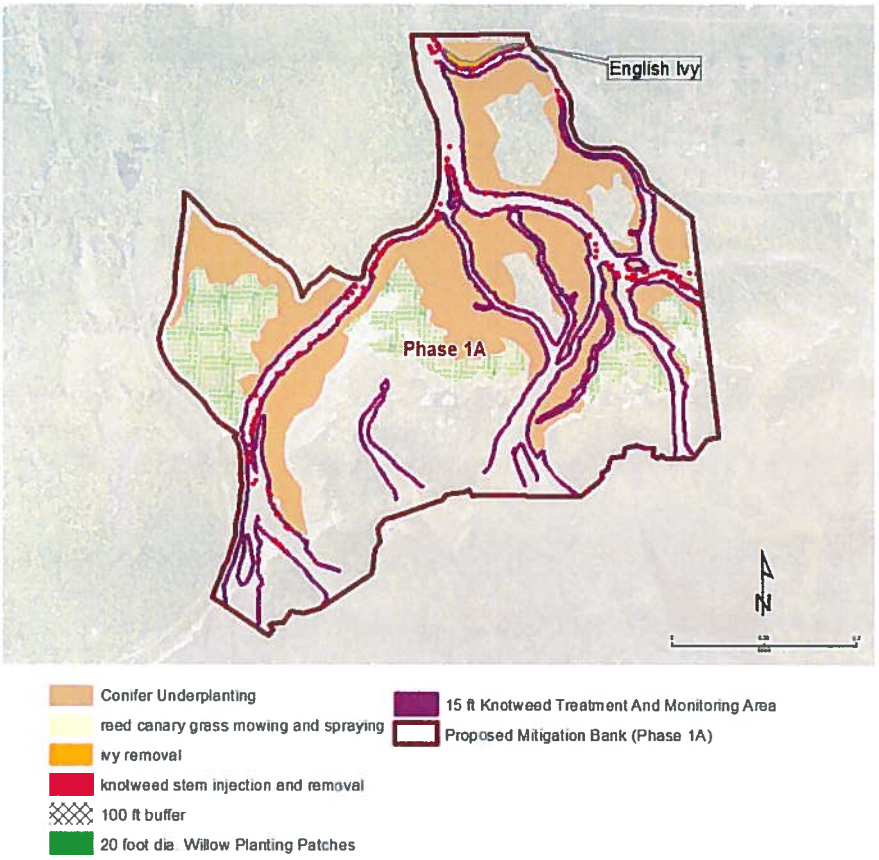
Lummi Nation Wetland and Habitat Mitigation Bank

2012 (Year 1) Monitoring Report for 2011 Enhancement Areas
Phase 1A Nooksack Delta Site



Prepared For:

Interagency Review Team
Lummi Nation Wetland and Habitat Mitigation Bank

Prepared By:

Jeremy Freimund, P.H.	Lummi Nation Water Resources Manager
Michael Muscari, PWS	ESA Senior Wetland Ecologist
Frank Lawrence III	Lummi Nation Water Resources Specialist
Gerry Gabrisch	Lummi Nation GIS Manager
Craig Dolphin	Lummi Nation Natural Resources Analyst

July 2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Summary of 2012 (Year 1) Monitoring Activities	
Name of Mitigation Bank	Lummi Nation Wetland and Habitat Mitigation Bank
Bank Phase	Phase 1A
U.S. Army Corps of Engineers Reference Number	NWS-2008-1519-SO
Bank Sponsor	Lummi Natural Resources Department
Project Lead	Jeremy R. Freimund, P.H.; Water Resources Manager; jeremyf@lummi-nsn.gov; 360-312-2314
Field Lead	Frank Lawrence III; Natural Resource Specialist; 360-312-2309
Contracted Technical Support	Michael Muscari, PWS; Senior Wetland Ecologist, ESA – Northwest Biological Research Group; 206-789-9658
Monitoring Dates:	Willow Plantings: August 7, 13, 20-21, 2012 Conifer Underplantings: September 28, 2012 and October 9 and 12, 2012 English Ivy: November 9, 2012
Treatment Dates: Mowing Plots and Willow Planting	Mowing/Willow Planting Begins: March 23, 2011 Mowing/Willow Planting Completed: May 2, 2011
Treatment Dates: Mowing Reed Canarygrass Areas for 2012 Planting Season	Mow Area 1 (2.68 acres): July 26 – Aug. 1, 2011 Mow Area 2 (2.67 acres): Aug. 10 – Aug. 16, 2011
Treatment Dates: Herbicide Application Area 1 and Area 2	September 23-24, 2011
Treatment Dates: English Ivy Removal	October 17-21, 2011 December 6-13, 2011

INTRODUCTION

The purpose of this 2012 (Year 1) Monitoring Report is to document the monitoring results for the enhancement activities conducted during 2011 for Phase 1A of the Lummi Nation Wetland and Habitat Mitigation Bank (Bank). Phase 1A is located at the Nooksack Delta Site. Because of the large enhancement area within the Phase 1A site, the work is being conducted in stages that started during the first quarter of 2011. A 2011 As-Planted Report, which documents the enhancement activities conducted during 2011, was submitted to the Interagency Review Team (IRT) during March 2013. Monitoring of the 2011 enhancement activities was conducted during 2012 (Year 1).

This monitoring report is part of the documentation required to demonstrate attainment of the performance standards established in the Mitigation Banking Instrument (MBI). The IRT must review and approve the documentation as a condition of awarding and releasing additional Bank credits. The IRT award of credits will be reflected in a letter issued using IRT letterhead and signed by the IRT Chair (i.e., the U.S. Army Corps of Engineers, District Engineer or his/her designee).

Documentation of the Baseline Vegetation Conditions of the Nooksack Delta Site – Phase 1A was completed in December 2010 and accepted by the IRT. Because of the limited planting window and anticipation that the MBI would be executed during the second quarter of 2011, enhancement activities were initiated during the first quarter of 2011. Although the MBI was not executed until July 6, 2012, the IRT stated that the December 2010 Baseline Vegetation Conditions report would be the basis for evaluating attainment of the performance standards identified in the MBI.

The overall monitoring and reporting schedule for the Bank development period is shown in Table 1. Monitoring and reporting will be conducted for 10 years for each stage of the Bank development, beginning with Year 0 for each treatment area completed. Treatment in all areas is expected to take 4 years; therefore, the overall schedule will extend for 14 years. Monitoring reports for the earlier stages of the Phase 1A site development will continue beyond Year 10 until Year 10 is reached for the latest planting stage

Table 1. Phase 1A Monitoring and Reporting Schedule

Action	Year[1]										
	0	1	2	3	4	5	6	7	8	9	10
Monitor Reed Canarygrass and Yellow Flag Iris and Shrub Plantings	x[2]	x		x		x		x			x
English Ivy	x[2]	x		x		x		x			x
Monitor Knotweed	x[2]	x	x	x	x	x	x	x	x	x	x
Monitor Conifer Underplantings	x[2]	x		x		x		x			x
Monitoring Reports	As-planted report[2]	x	x	x	x	x		x			x

[1] Monitoring and reporting will be conducted for 10 years for each stage of the Bank development beginning with Year 0 for each treatment area completed. Treatment in all areas is expected to take at least 4 years; therefore the overall schedule will extend for at least 14 years. As described below, monitoring reports for the earlier stages of the Phase 1A site development will continue beyond Year 10 until Year 10 is reached for the latest planting stage.

[2] Documentation of enhancement actions ("As-Planted Reports").

PHASE 1A DESIGN PLAN SUMMARY

The enhancement design for the Phase 1A Nooksack Delta Site is focused on (1) removing and managing invasive plant species; and (2) increasing native plant species richness through planting native shrubs and coniferous trees. Following the weed control effort and plantings, the primary work on the site will involve monitoring and maintenance activities.

The Nooksack Delta Site Phase 1A enhancement design is comprised of the following elements in the general sequence that they will occur:

1. Designate and protect the land within the site through a conservation easement;
2. Eradicate or control invasive species;
3. Plant native conifer species within the deciduous forests; and
4. Monitor effectiveness of treatments and underplantings, and repeat as needed to meet performance standards.

The areas designated for the different wetland enhancement measures are shown on Figures 1 and 2. Specific design elements for the enhancement areas are summarized in Table 2 and described below.

Table 2. Phase 1A Enhancement Actions Completed in 2011

Type of Wetland Enhancement Action	Area (acres)
Knotweed removal: treatment and monitoring area	0
Weed removal/willow planting: reed canarygrass, yellow flag iris	29.7
Weed removal: English ivy	2.1
Conifer underplanting	0
Total Enhancement Area 2011	**31.8**

BANK OBJECTIVES AND PERFORMANCE STANDARDS

The Bank's success will be measured by documenting progress toward achieving the objectives and associated performance standards identified in the MBI. The prescribed performance standards are intended to measure the success of the ecological restoration and enhancement efforts at the Bank. Only the Phase 1A performance standards related to the work performed in 2011 (Year 0 for this stage) are described below.

Objective 1: Permanently protect aquatic ecosystem functions of the Nooksack Delta Site by instituting the MBI and implementing a conservation easement with permanent funding for site stewardship.

Performance Standard: The conservation easement and financial assurances are included in the MBI. The IRT approved the MBI on July 6, 2012 and the Conservation Easement was approved by all parties and recorded on October 17, 2012. The IRT released 19 credits on October 18, 2012.

Objective 2: Enhance ecological function by removing and managing reed canarygrass and yellow flag iris and replanting with native shrubs.

Performance Standard: Planting of willows in reed canarygrass and yellow flag iris treatment area (shrub plots) completed according to IRT approved plans. Documentation of performance standard achievement provided in as-planted reports (one for each of the anticipated four planting years/stages) showing completed planting. The as-planted reports, which must be approved by the IRT, will include a species list, plant spacing and density, a global positioning system (GPS) map showing the center of each planting plot, and final planted acreages each year.

Objective 3: Enhance ecological function by removing and managing English ivy from a 2.1-acre forested area.

Performance Standard:

3A Cutting of English ivy and root pulling with hand tools in treatment area. Documentation will include GPS map showing the perimeter of the treatment area and photographs of removal operations.

YEAR 1 MONITORING OF PHASE 1A AREAS PLANTED IN 2011

The areas where enhancement actions were completed in 2011 are shown on Figure 1 and summarized in Table 2. Work completed in 2011 included removal of reed canarygrass and yellow flag iris, planting of willow stakes, and removal of English ivy.

Reed Canarygrass/Yellow Flag Iris Treatment and Willow Plantings

Work completed during 2011 included 29.7 acres of reed canarygrass treatment and willow plantings. Willows were planted within 753 plots each measuring approximately 20 feet in diameter. The locations for the plots planted with willow stakes in 2011 were established in a grid pattern with 40-foot on center spacing using a Geographic Information System (GIS). The latitude and longitude of each plot was then loaded from the GIS into a mapping grade, hand-held global positioning system (GPS) unit with a horizontal accuracy of ± 2 feet (Trimble GeoXT). The GPS unit was used to locate the plot centers in the field. Each plot was designated with a unique identifier (WP001 – WP753) for data tracking purposes and a wood lathe with the unique identifier written on it was used to mark the plot center. Survey flagging was attached to the wood lathe to help field locate the plot centers.

Reed canarygrass within a radius of 10 feet of the plot center was mowed starting on March 23, 2011 using gas-powered brush cutters. Earlier access to the site was limited due to high river flows or unsuitable weather conditions. Following the mowing, live willow stakes were planted in the 20-foot diameter plots. Three species of willow stakes were planted: Pacific (*Salix lasiandra*), Sitka (*S. sitchensis*), and Hooker's (*S. hookeriana*). Stake spacing averaged 2 to 3 feet on center (approximately 57 stems per plot or 1,425 stems per acre).

A total of 42,000 willow stakes were planted within the 753 plots in 2011 over the March 23 through May 2, 2011 period. In some of the plots, the planting density was reduced due to unsuitable planting conditions (e.g., large woody debris, deep holes/excessive water depth) encountered in the field. Following the planting season, the GIS was used to draw a polygon around the planted plot locations, which had been located in the field using the GPS. Using this approach, the overall treatment area for 2011 was determined to be 29.7 acres. For comparison/validation purposes, at a planting density of approximately 1,425 stems per acre the 42,000 willow stakes would be enough to treat 29.5 acres. Similarly, at an average planting density of 25 plots per acre, the 753 plots equates to a treatment area of 30.12 acres.

Monitoring of the willow patches was conducted at 38 randomly selected plots covering 5% of the total number of plots. Plots selected for sampling are shown in orange in Figure 2. Five photographs were taken at each sample plot in 2012 to document changes in shrub cover over time. One photograph from each of the sample plots is provided in Appendix A.

Monitoring results will be compared with performance standards described in Table C.2 of the MBI.

Aerial Shrub Cover within Willow Plots

Performance standards for the willow planting plots include at least 10% areal coverage by native shrubs within planted plots in Year 1 (2012). At each of the 38 randomly selected plots, the cover provided by native willows was visually estimated. Two staff members made estimates of aerial cover and compared estimates. The average of the two estimates was recorded.

Results of the aerial coverage estimates are shown in Table 3. Only three of the plots were estimated to have 10% or greater shrub cover. The average coverage provided by native shrubs over all 38 sample plots decreased from 13.7% (SE 1.17) in Year 0 to 4.5% (SE 0.67) in Year 1. The decrease in cover is the result of some willow stakes dying between years. The 4.5% cover estimate does not meet the performance standard of 10% by Year 1 as described in the MBI.

Although growth was vigorous on many of the live willow stems, growth was also vigorous for the reed canary grass and many dead willow stems were observed within the sampled plots. Evidence of bark browsing (probably due to voles) was observed on many of the dead stems. Stems drying prior to planting or dry conditions during the summer establishment period may also have contributed to stem death, which resulted in a decrease in shrub cover. Replanting of some willow plots may be necessary in order to meet Year 3 performance standards of 20% shrub cover.

Table 3. Willow Aerial Coverage – Year 1 of 2011 Plantings (5% of total shrub plots)

Station Identifier	Shrub Cover Year 0 (%)	Shrub Cover Year 1 (%)
WP014	10	5
WP058	10	2
WP075	30	No data
WP115	10	5
WP191	10	10
WP199	10	5
WP220	10	5
WP243	10	5
WP294	35	5
WP305	30	2
WP342	10	5
WP388	10	7
WP402	10	2
WP405	15	2
WP410	10	5
WP417	10	2
WP428	10	2
WP435	10	2
WP440	10	2
WP465	10	2
WP466	15	2
WP501	10	2
WP515	5	2
WP528	10	5
WP531	10	5
WP542	10	2
WP608	25	25
WP653	25	5
WP692	10	2
WP698	10	5
WP701	10	2
WP730	25	5
WP742	15	5
WP768	10	2

Station Identifier	Shrub Cover Year 0 (%)	Shrub Cover Year 1 (%)
WP770	25	10
WP784	10	5
WP791	15	7
WP804	10	2
Overall Average	**13.7 (SE 1.17)**	**4.5 (SE 0.67)**

Diameter of Willow Plots

Performance standards for the willow planting plots also include an increase in the diameter of the plot in later years (Year 7 and Year 10). In order to provide a basis of comparison for the future diameter of the plots, the diameter of the plots was measured for Year 0 (2011). Three measurements of the plot diameter were made at each sample plot and averaged for each plot. Diameter measurements were taken near the end of the growing season (October) using a fiberglass tape stretched through the center of the plot (marked with wood lath). Measurements were made from the outermost portion of the willow stems. The mean diameter for each individual plot will be the baseline used to compare with the mean diameter that will be measured in Year 7 and Year 10.

Performance standards for Year 7 include a 10% minimum increase in plot diameter for at least one-quarter of the plots. Although performance standards for plot diameter are not required for Year 1, the diameters were measured to provide information on whether plot growth is on a positive trajectory toward achieving performance standards in later years. As summarized in Table 4, the average plot diameter increased at all plots by approximately 1% over the average diameter in 2011; therefore, the plots appear to be increasing in size.

Table 4. Willow Plots Diameter – Year 1 of 2011 Plantings (5% of total shrub plots)

Station Name	Mean Diameter in Year 0 (ft)	Mean Diameter in Year 1 (ft)	Year 1 (% Change)	Target Diameter (+10%) by Year 7 (ft)
WP014	20.4	20.8	+1%	22.4
WP058	21.2	21.4	+1%	23.3
WP075	21.7	No data	No data	23.9
WP115	21.4	22.3	+1%	23.5
WP191	21	21.1	+1%	23.1
WP199	20.8	19.6	+1%	22.9
WP220	21.5	20.4	+1%	23.7
WP243	20.4	20.3	+1%	22.5
WP294	20.1	21.2	+1%	22.1
WP305	21.4	19.5	+1%	23.5
WP342	21.4	19.8	+1%	23.5
WP388	21.8	21.2	+1%	24
WP402	21.3	20.6	+1%	23.4
WP405	13.8	14.1	+1%	15.1
WP410	21	21.5	+1%	23.1
WP417	22.2	19.9	+1%	24.4
WP428	21.7	18.1	+1%	23.8
WP435	20	17.1	+1%	22
WP440	21	17.9	+1%	23.1
WP465	19.3	12.6	+1%	21.3
WP466	19.5	20.9	+1%	21.4
WP501	19	19.7	+1%	20.9
WP515	19	19.1	+1%	20.9
WP528	18.6	18.1	+1%	20.5
WP531	17.6	17.2	+1%	19.4
WP542	20.7	15.0	+1%	22.8
WP608	18.7	17.7	+1%	20.6
WP653	16.8	18.1	+1%	18.5
WP692	20.4	21.0	+1%	22.4
WP698	20.7	20.6	+1%	22.7
WP701	21	20.3	+1%	23.1
WP730	21.3	22.5	+1%	23.4
WP742	19.1	20.1	+1%	21
WP768	19.5	19.0	+1%	21.5

Station Name	Mean Diameter in Year 0 (ft)	Mean Diameter in Year 1 (ft)	Year 1 (% Change)	Target Diameter (+10%) by Year 7 (ft)
WP770	18.5	19.6	+1%	20.4
WP784	20.1	20.7	+1%	22.1
WP791	22	21.5	+1%	24.2
WP804	20.2	21.8	+1%	22.2

English Ivy Removal

2011 Baseline

Pursuant to the MBI, sampling along transects and within sample plots will provide a measure of the area covered by English ivy. The cover estimates will be used to record progress toward meeting performance standards in later years (Years 3, 5, 7, and 10).

The perimeter of the English ivy infestation area was surveyed with a GPS unit during 2011 to aid with maintenance and monitoring. Randomly placed transects were set up and monitored in 2011 within the ivy infestation area to measure the baseline condition before treatment (Figure 3). Line intercept sampling was conducted along the transects and visual estimates of ivy cover were made within 10-foot diameter plots adjacent to the transects. Pre-treatment monitoring showed that average ivy cover was 30.4% (SE 8.9) in the sample plots and 42.7% (SE 28.7) along line intercept transects.

Following the baseline monitoring, English ivy was removed from the 2.1-acre treatment area using hand tools. Aboveground material was cut and roots were grubbed out where possible. All material was removed from the site and disposed of properly at an offsite location.

2012 Monitoring

No performance standards or credit release is associated with the English ivy removal area for Year 1 (2012). Data were collected in 2012 to provide information on the efficacy of treatment and whether the site is on trajectory to meet the Year 3 performance standard of less than 40% cover of ivy.

Photographs showing the conditions along ivy removal transects in November 2012 are provided in Appendix B. In 2012, the average ivy cover was 10.8% (SE 5.5) in the sample plots and 35.6% (SE 31.7) along line intercept transects. Beginning in summer 2013, work on this site will involve spot spraying with herbicide of new English ivy sprouts. With continued treatment of the remaining ivy, the site should be on track to meeting performance standards in Year 3 (2014).

SUMMARY

The enhancement actions taken in 2011 (willow plantings) were monitored during fall 2012, to determine if performance standards for Year 1 were met. The results of monitoring show that the shrub planting plots did not meet the 10% cover performance standard for Year 1. The failure of willow stakes planted in 2011 may be the result of many factors, many of which (herbivory from voles and beaver) are difficult to control in a remote setting. The willow plots planted in 2011 will be revisited in spring 2013 and any that appear to have significant die-off of the original willow stakes will be replanted. Care will be taken to use fresh, healthy willow stakes and the stakes will be kept moist and planted promptly. The diameter of the willow plots increased by 1% over the baseline measurements; therefore it appears they are on track to meet performance standards in later years.

No performance standards are required for the ivy or conifer plantings in 2012. The monitoring shows that the ivy control efforts and the conifer underplantings are on track to meet the applicable performance standards in later years. Weeding of ivy will continue in 2013 to further maintain control of the weed. Monitoring shows that conifer density exceeds expectations for 2012. Conifers will be monitored again in 2013 and replanted if it is determined that mortality leads to low density.

The results of enhancement actions and monitoring are being tracked using a custom-built database. An example of the summary information reported by the database is included in Appendix C.

FIGURES

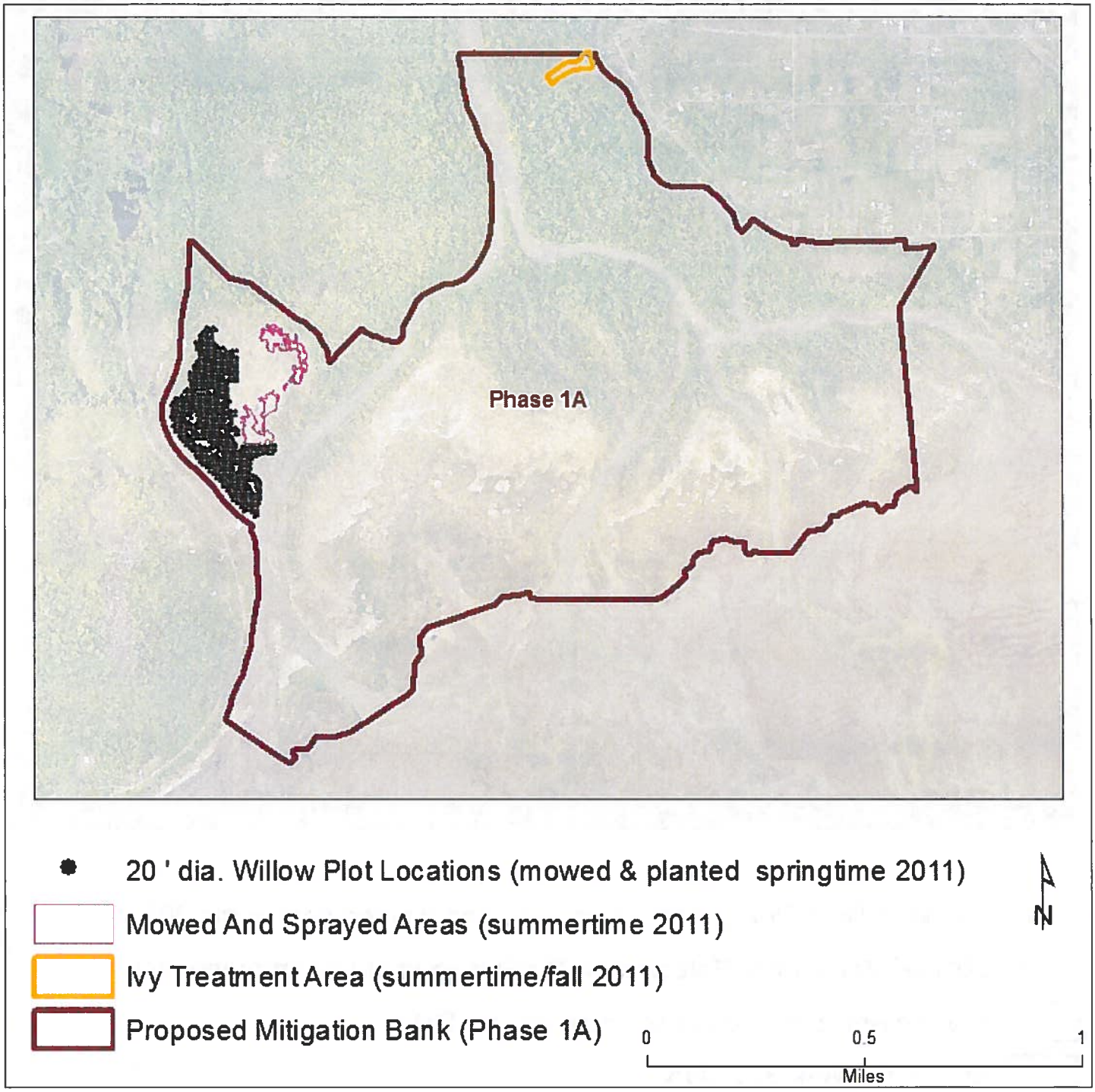


Figure 1. Enhancement Actions Completed in 2011 (Phase 1A)

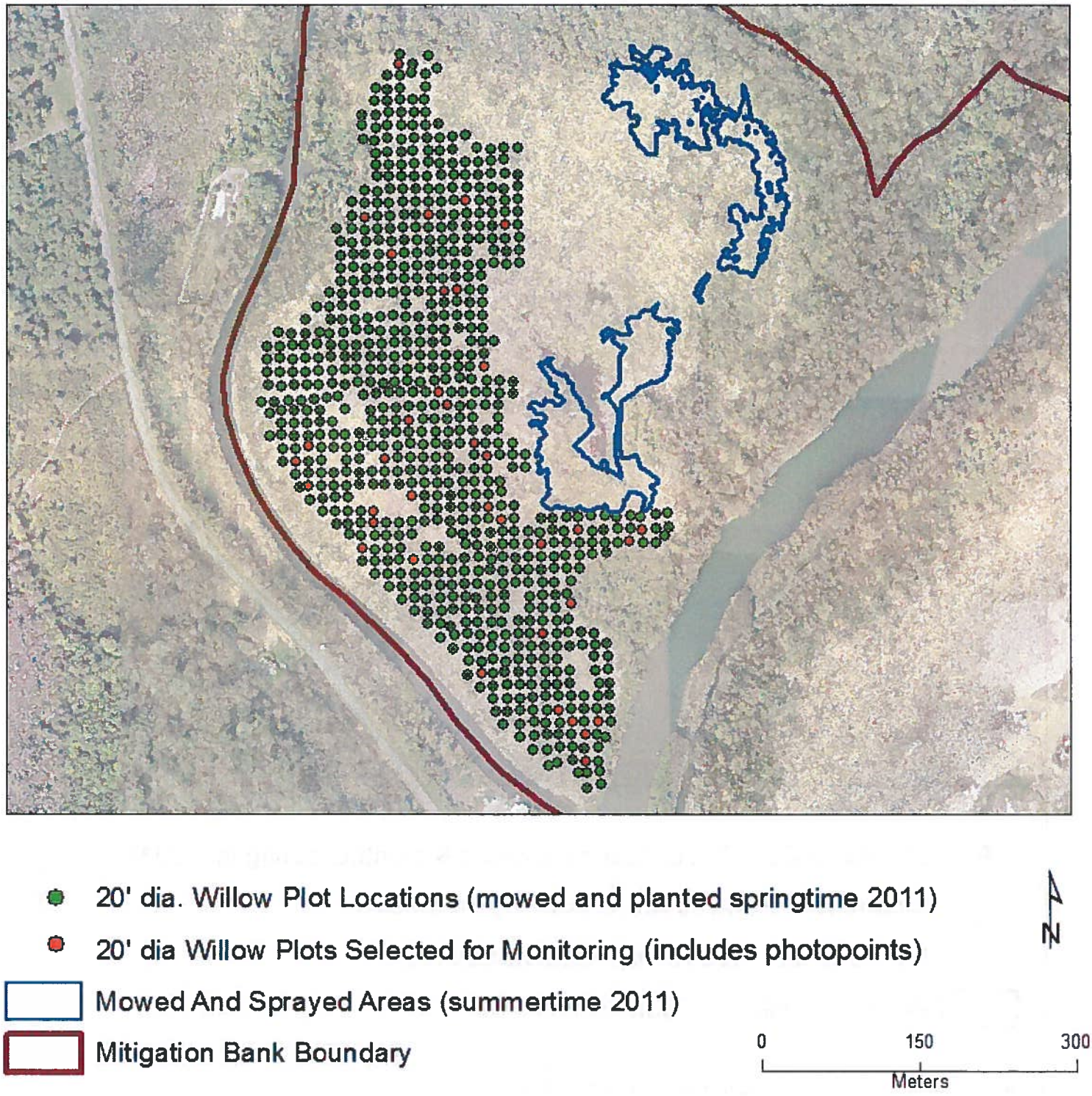


Figure 2. Reed Canarygrass/Yellow Flag Iris Treatment and Willow Plantings 2011 (Phase 1A)

Ivy Treatment Area (summertime/fall 2011)

Ivy Monitoring Transects (Photo points at both ends of all transects)

Ivy Monitoring Plot Centers

Mitigation Bank Boundary

N

0 30 60

Meters

Figure 3. English Ivy Removal Area 2011 (Phase 1A)

APPENDIX A: Photographs of Willow Plots

(End of Year 1)

(Photographs taken in September 2012 from south end of sample plots facing north.)

WP014

WP058

No Photo

WP075

WP115

WP191

WP199

WP220

WP243

WP294

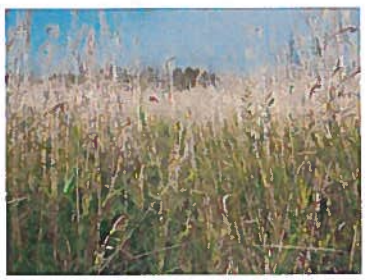
WP305

WP342

WP388

WP402

WP405



WP410

WP417

WP428

WP435

WP440

WP465

WP466

WP501

WP515

WP528

WP531

WP542

WP608

WP653

WP692

WP698

WP701

WP730

WP742

WP768

WP770

WP784

WP791

WP804

APPENDIX B: Photographs of Ivy Treatment Areas

(End of Year 1)

Photographs taken in fall of 2012. Ivy control efforts were conducted during fall of 2011.

Transect 1 Plot900

Transect 2 Plot906

Transect 3 Plot909

Transect 4 Plot910

Transect 5 Plot913

APPENDIX C: Monitoring Database Summary Form (example)

Individual Monitoring Zones in Phase 1A / Nooksack Delta

2011 Ivy Management Zone

Ivy Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	30.4	8.88	17
M1	10.8	5.46	17

Ivy Percent Cover in Line-Intercept Stations by Monitoring Stag

Stage:	MeanCoverage (%)	Std.Err.	Lines Monitored:
Baseline	42.7	28.65	5
M1	35.6	31.671	5

2011 Reed Can Grass Control Zone

Native Plant Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	13.7	1.173	38
M1	4.5	0.673	37

Percentage of Patches Exceeding Patch-Specific Baseline Diameter by 10%

Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	38
M1	0.0	100.0	37

2012 Conifer Underplanting Zone

Total Acres Monitored in Belt Transects By Stage and Year

	M0:	M1:	M3:	M5:	M7:	M10:
2012	0.796	0	0	0	0	0
	0.8	0	0	0	0	0

Tree Height Statistics by Monitoring Stage

Stage:	Mean Height (ft)	Std.Err.	Trees Measured:
Baseline	2.23	0.02	463

Conifer Densities (Trees per Acre) by Monitoring Stage

Stage:	Mean ConiferDensity:	StdErr:	Transects:
Baseline	586.83	34.39	39

2012 Reed Can Grass Control Zone

Native Plant Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	5.5	1.566	34

Percentage of Patches Exceeding Patch-Specific Baseline Diameter by 10%

Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	36

Willow Patch Diameter Monitoring Statistic Details (ft)

Subarea Name: 2011 Reed Can Grass Control Zone

Station Name	Measured Baseline:	Alternative Baseline:	Target Diameter:	StageName:	Mean:	Count:	StDev:	StdErr:
WP305	21.37		23.51	M1	19.5	3	4.75	1.58
WP342	21.4		23.54	Baseline	21.4	3	0.95	0.32
WP342	21.4		23.54	M1	19.81	3	2.83	0.94
WP388	21.8		23.98	Baseline	21.8	3	0.17	0.06
WP388	21.8		23.98	M1	21.19	3	1.22	0.41
WP402	21.3		23.43	Baseline	21.3	3	0.56	0.19
WP402	21.3		23.43	M1	20.61	3	0.38	0.13
WP405	13.77		15.15	Baseline	13.77	3	1	0.33
WP405	13.77		15.15	M1	14.11	3	1.25	0.42
WP410	21.03		23.13	Baseline	21.03	3	1.07	0.36
WP410	21.03		23.13	M1	21.53	3	0.58	0.19
WP417	22.2		24.42	Baseline	22.2	3	1.54	0.51
WP417	22.2		24.42	M1	19.94	3	4.16	1.39
WP428	21.67		23.84	Baseline	21.67	3	0.49	0.16
WP428	21.67		23.84	M1	18.08	3	1.63	0.54
WP435	19.97		21.97	Baseline	19.97	3	3.52	1.17
WP435	19.97		21.97	M1	17.14	3	4.78	1.59
WP440	21.03		23.13	Baseline	21.03	3	0.4	0.13
WP440	21.03		23.13	M1	17.89	3	5.03	1.68
WP465	19.33		21.26	Baseline	19.33	3	1.67	0.56
WP465	19.33		21.26	M1	12.61	3	11.13	3.71
WP466	19.47		21.42	Baseline	19.47	3	2.8	0.93
WP466	19.47		21.42	M1	20.94	3	3.54	1.18
WP501	19.03		20.93	Baseline	19.03	3	0.78	0.26
WP501	19.03		20.93	M1	19.69	3	2.05	0.68
WP515	18.97		20.87	Baseline	18.97	3	1.04	0.35
WP515	18.97		20.87	M1	19.05	3	2.18	0.73
WP528	18.6		20.46	Baseline	18.6	3	0.56	0.19
WP528	18.6		20.46	M1	18.06	3	1.43	0.48
WP531	17.6		19.36	Baseline	17.6	3	3.86	1.29
WP531	17.6		19.36	M1	17.2	3	3	1
WP542	20.7		22.77	Baseline	20.7	3	1.21	0.4
WP542	20.7		22.77	M1	15	3	3.55	1.18
WP608	18.73		20.60	Baseline	18.73	3	3.74	1.25
WP608	18.73		20.60	M1	17.72	3	4.7	1.57
WP653	16.83		18.51	Baseline	16.83	3	2.9	0.97
WP653	16.83		18.51	M1	18.14	3	3.63	1.21
WP692	20.37		22.41	Baseline	20.37	3	0.25	0.08
WP692	20.37		22.41	M1	20.97	3	0.46	0.15
WP698	20.67		22.74	Baseline	20.67	3	0.68	0.23
WP698	20.67		22.74	M1	20.58	3	0.22	0.07
WP701	21.03		23.13	Baseline	21.03	3	0.06	0.02
WP701	21.03		23.13	M1	20.25	3	1.37	0.46
WP730	21.3		23.43	Baseline	21.3	3	1.31	0.44
WP730	21.3		23.43	M1	22.5	3	1.02	0.34
WP742	19.13		21.04	Baseline	19.13	3	1.52	0.51
WP742	19.13		21.04	M1	20.05	3	1.11	0.37
WP768	19.53		21.48	Baseline	19.53	3	0.81	0.27
WP768	19.53		21.48	M1	18.97	3	1.58	0.53
WP770	18.5		20.35	Baseline	18.5	3	1.48	0.49
WP770	18.5		20.35	M1	19.61	3	1.22	0.41
WP784	20.1		22.11	Baseline	20.1	3	0.2	0.07
WP784	20.1		22.11	M1	20.67	3	0.36	0.12
WP791	22		24.20	Baseline	22	3	0.36	0.12
WP791	22		24.20	M1	21.5	3	0.54	0.18
WP804	20.17		22.19	Baseline	20.17	3	1.96	0.65
WP804	20.17		22.19	M1	21.78	3	1.06	0.35

Willow Patch Diameter Monitoring Statistic Details (ft)

Subarea Name: 2012 Reed Can Grass Control Zone

Station Name	Measured Baseline:	Alternative Baseline:	Target Diameter:	StageName:	Mean:	Count:	StDev:	StdErr:
WP0012	21.08		23.19	Baseline	21.08	3	0.8	0.27
WP0036	15.14		16.65	Baseline	15.14	3	13.22	4.41
WP0038	21.5		23.65	Baseline	21.5	3	0.79	0.26
WP0054	20.53		22.58	Baseline	20.53	3	0.21	0.07
WP0127	20.44		22.48	Baseline	20.44	3	0.88	0.29
WP0152	14.03		15.43	Baseline	14.03	3	5.18	1.73
WP0155	18.2		20.02	Baseline	18.2	3	1.98	0.66
WP0171	18.78		20.66	Baseline	18.78	3	3.39	1.13
WP0174	21.39		23.53	Baseline	21.39	3	0.1	0.03
WP0198	19.22		21.14	Baseline	19.22	3	0.29	0.1
WP0221	11.89		13.08	Baseline	11.89	3	10.46	3.49
WP0229	11.89		13.08	Baseline	11.89	3	10.39	3.46
WP0272	17.5		19.25	Baseline	17.5	3	5.02	1.67
WP0282	19.36		21.30	Baseline	19.36	3	2.41	0.8
WP0333	14.67		16.14	Baseline	14.67	3	12.74	4.25
WP0351	20.42		22.46	Baseline	20.42	3	0.71	0.24
WP0353	18.14		19.95	Baseline	18.14	3	4.2	1.4
WP0379	21.83		24.01	Baseline	21.83	3	0.87	0.29
WP0463	23.42		25.76	Baseline	23.42	3	0.44	0.15
WP0726	20.39		22.43	Baseline	20.39	3	0.27	0.09
WP0835	11.72		12.89	Baseline	11.72	3	10.63	3.54
WP0873	11.64		12.80	Baseline	11.64	3	11.42	3.81
WP0882	20.25		22.28	Baseline	20.25	3	1.34	0.45
WP1009	20.39		22.43	Baseline	20.39	3	2.36	0.79
WP1034	19.33		21.26	Baseline	19.33	3	0.59	0.2
WP1053	21.17		23.29	Baseline	21.17	3	1.66	0.55
WP1080	21.97		24.17	Baseline	21.97	3	0.29	0.1
WP1106	22		24.20	Baseline	22	3	0.14	0.05
WP1109	20.86		22.95	Baseline	20.86	3	0.65	0.22
WP1124	21.28		23.41	Baseline	21.28	3	0.62	0.21
WP1164	0	17.85	19.64	Baseline	0	3	0	0
WP1166	0	17.85	19.64	Baseline	0	3	0	0
WP1167	17.75		19.53	Baseline	17.75	3	4.77	1.59
WP1179	20.53		22.58	Baseline	20.53	3	1.17	0.39
WP1193	22.45		24.70	Baseline	22.45	3	1.49	0.5
WP1200	21.39		23.53	Baseline	21.39	3	0.13	0.04

Willow Patch Native Plant Coverages (%)

Subarea Name: 2011 Reed Can Grass Control Zone

Station Name	Measured Baseline:	M1:	M2:	M3:	M4:	M5:	M6:	M7:	M8:	M9:	M10:
WP014	10	5									
WP058	10	2									
WP075	30										
WP115	10	5									
WP191	10	10									
WP199	10	5									
WP220	10	5									
WP243	10	5									
WP294	35	5									
WP305	30	2									
WP342	10	5									
WP388	10	7									
WP402	10	2									
WP405	15	2									
WP410	10	5									
WP417	10	2									
WP428	10	2									
WP435	10	2									

Willow Patch Native Plant Coverages (%)

Subarea Name: 2011 Reed Can Grass Control Zone

Station Name	Measured Baseline:	M1:	M2:	M3:	M4:	M5:	M6:	M7:	M8:	M9:	M10:
WP440	10	2									
WP465	10	2									
WP466	15	2									
WP501	10	2									
WP515	5	2									
WP528	10	5									
WP531	10	5									
WP542	10	2									
WP608	25	25									
WP653	25	5									
WP692	10	2									
WP698	10	5									
WP701	10	2									
WP730	25	5									
WP742	15	5									
WP768	10	2									
WP770	25	10									
WP784	10	5									
WP791	15	7									
WP804	10	2									

Willow Patch Native Plant Coverages (%)

Subarea Name: 2012 Reed Can Grass Control Zone

Station Name	Measured Baseline:	M1:	M2:	M3:	M4:	M5:	M6:	M7:	M8:	M9:	M10:
WP0012	5										
WP0036	2										
WP0038	2										
WP0054	5										
WP0127	2										
WP0152	51										
WP0155	22										
WP0171	2										
WP0174	5										
WP0198	15										
WP0221	2										
WP0229	2										
WP0272	2										
WP0282	2										
WP0333	1										
WP0351	10										
WP0353	2										
WP0379	2										
WP0463	4										
WP0726	5										
WP0835	2										
WP0873	1										
WP0882	2										
WP1009	2										
WP1034	2										
WP1053	2										
WP1080	2										
WP1106	5										
WP1109	10										
WP1124	2										
WP1167	2										
WP1179	2										
WP1193	5										
WP1200	5										

Lummi Nation Wetland and Habitat Mitigation Bank

1A Willow Patch Monitoring Details

Willow Patch Diameters (ft

Subarea Name: 2011 Reed Can Grass Control Zone

Station Name	Measured Baseline:	Alternative Baseline:	Target Diameter:	M1:	M2:	M3:	M4:	M5:	M6:	M7:	M8:	M9:	M10:
WP014	20.37		22.41	20.81									
WP058	21.17		23.29	21.36									
WP075	21.7		23.87										
WP115	21.37		23.51	22.3									
WP191	21		23.10	21.11									
WP199	20.83		22.91	19.61									
WP220	21.5		23.65	20.42									
WP243	20.43		22.47	20.33									
WP294	20.07		22.08	21.17									
WP305	21.37		23.51	19.5									
WP342	21.4		23.54	19.81									
WP388	21.8		23.98	21.19									
WP402	21.3		23.43	20.61									
WP405	13.77		15.15	14.11									
WP410	21.03		23.13	21.53									
WP417	22.2		24.42	19.94									
WP428	21.67		23.84	18.08									
WP435	19.97		21.97	17.14									
WP440	21.03		23.13	17.89									
WP465	19.33		21.26	12.61									
WP466	19.47		21.42	20.94									
WP501	19.03		20.93	19.69									
WP515	18.97		20.87	19.05									
WP528	18.6		20.46	18.06									
WP531	17.6		19.36	17.2									
WP542	20.7		22.77	15									
WP608	18.73		20.60	17.72									
WP653	16.83		18.51	18.14									
WP692	20.37		22.41	20.97									
WP698	20.67		22.74	20.58									
WP701	21.03		23.13	20.25									
WP730	21.3		23.43	22.5									
WP742	19.13		21.04	20.05									
WP768	19.53		21.48	18.97									
WP770	18.5		20.35	19.61									
WP784	20.1		22.11	20.67									
WP791	22		24.20	21.5									
WP804	20.17		22.19	21.78									